

SEASONAL OCCURENCE, MORTALITY AND DIMENSIONS OF SARDINE EGGS (*SARDINA PILCHARDUS* (WALBAUM) OFF PORTUGAL

by

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RESUME.— Des oeufs de sardines ont été collectés pendant une année entière (août 1979 à juillet 1980), le long de la partie centrale de la côte portugaise, selon un quadrillage comprenant 10 stations. Les pêches ont été faites au moyen d'un filet circulaire d'un mètre de diamètre (maille de 0,500 mm), en traits obliques de 10 minutes à une vitesse de 1,5 à 2 noeuds. Le volume moyen d'eau filtrée était de 300 m³. Deux maxima de ponte ont été observés en décembre et avril. Il a été établi un changement très net dans la mortalité des oeufs selon les saisons. Enfin il a été mis en évidence un cycle dans les tailles des capsules et des globules huileux des oeufs.

ABSTRACT.— Sardine eggs were sampled throughout a period of one year (August 1979 to July 1980), over a grid of 10 stations, on the central part of the portuguese coast. Sampling was carried with a 1 meter ring trawl of 0,500 mm mesh aperture, hauled on an oblique tow during 10 minutes at a velocity of 1.5 to 2 knots. The average volume of water strained was 300 m³. Two main peaks of spawning occured in December and April. A clear seasonal change in relative egg mortality was found. Finally we found a cyclic change of the mean dimensions of capsule and oil globule.

Sardina pilchardus fisheries are very important off Portugal. All data regarding the spawning of sardine on the portuguese coast is either incomplete or missing (Ramalho, 1927, 1933, Cruz, 1955, Pinto & Barraca, 1958, Dias & Jorge, 1973, Sobral, 1975, Ré, 1979).

In the present paper we try to assess the seasonal distribution of breeding, egg size and mortality in relation to some environmental factors.

MATERIAL AND METHODS

Sardine eggs were sampled throughout a period of one year (August 1979 to July 1980), over a grid of 10 stations in the inshore waters of the central part of the portuguese coast (figure 1).

Sampling was carried with a 1 meter ring trawl of 0,500 mm mesh aperture, hauled on an oblique path during 10 minutes at a constant velocity of 1.5 to 2 knots. The net was in all cases towed to a maximum depth of half the depth of the station. The average volume of water filtered was 300 m³.

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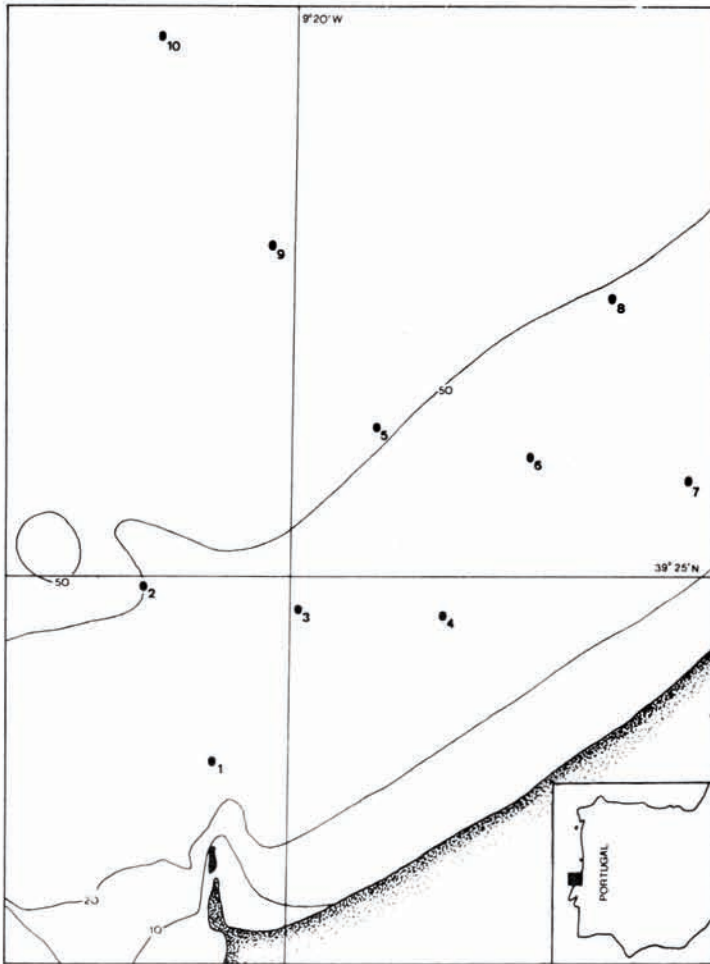


Fig 1.— Grid of stations sampled.

Fixation and preservation were made with 5 % formalin buffered with borax (pH 8.5 - 9).

Samples were sorted entirely at the laboratory, even when the eggs were very abundant.

Mortality was estimated on a subjective basis using criteria similar to those discussed by Lee (1961) ; eggs with a cloudy perivitelline fluid, signs of autolysis/ bacterial action were regarded as dead (mortality is referred here as the percentage of dead eggs in the total sample). Relative mortality was not referred to developmental stages described by Gamulin & Hure (1955).

The eggs were measured to the nearest one μm , with a calibrated eyepiece and a stereomicroscope. Measures of capsule and oil globule diameters were made on viable eggs, always on preserved material.

Hydrographic data were collected at two stages : temperatures were taken at the surface at each station, salinity and dissolved oxygen were measured at four inshore stations through the water column, normally one day after the collection of ichthyoplankton.

RESULTS

Seasonal changes in spawning activity.

Sardine eggs were collected throughout the whole sampling period except on August. The eggs were very abundant at two months (December and April), suggesting the existence of two peaks of spawning (figure 2).

In December the average number of eggs sampled ($\bar{x}$ = 26.8 eggs/m³), was somewhat higher than in April ($\bar{x}$ = 19.5 eggs/m³). In the referred months the majority of eggs were collected at inshore stations, with depths comprised between 40 and 70 meters.

Spawning was noted to be temperature dependent. Eggs were sampled in greatest numbers through temperature range of 13.8 to 15.4°C.

Mortality of the eggs.

Values of mortality varied from 12.6 % to 50.3 % with an annual average of 27.8 %.

A clear seasonal change in relative mortality was found (figure 3). This change seems to be related with temperature among other abiotic factors.

A clear correlation was found with surface temperatures registered at each station throughout the sampling period ($r = -0.25$, $p = 0.05$).

Higher values of mortality were found when average surface temperatures were lower (February, 32.6 % , March, 50.3 %). Lower values were found in October (15.6 %) and December (12.6 %).

No relationship was found between mortality and average salinities or dissolved oxygen.

The annual average mortality found (27.8 %) was somewhat lower than other values given by several authors (Lee, 1961, Aldebert & Tournier, 1971, Southward & Demir, 1974).

Dimensions of the eggs.

The seasonal changes in egg dimensions were finally analyzed. Our values for the dimensions of capsule and oil globule suggest a cyclic change through the year (figures 4 et 5).

Average capsule diameters varied from 1.665 to 1.524 mm with an annual mean of 1.588 mm. Average oil globule diameters varied from 0.154 to 0.126 mm with an annual mean of 0.139 mm.

The referred cyclic change seems to be unrelated with collected hydrographic data, nevertheless the lower values found for capsule and oil globule diameters were registered in March when the average surface temperatures were smaller. This fact seems to indicate some relationship between temperature and egg dimensions.

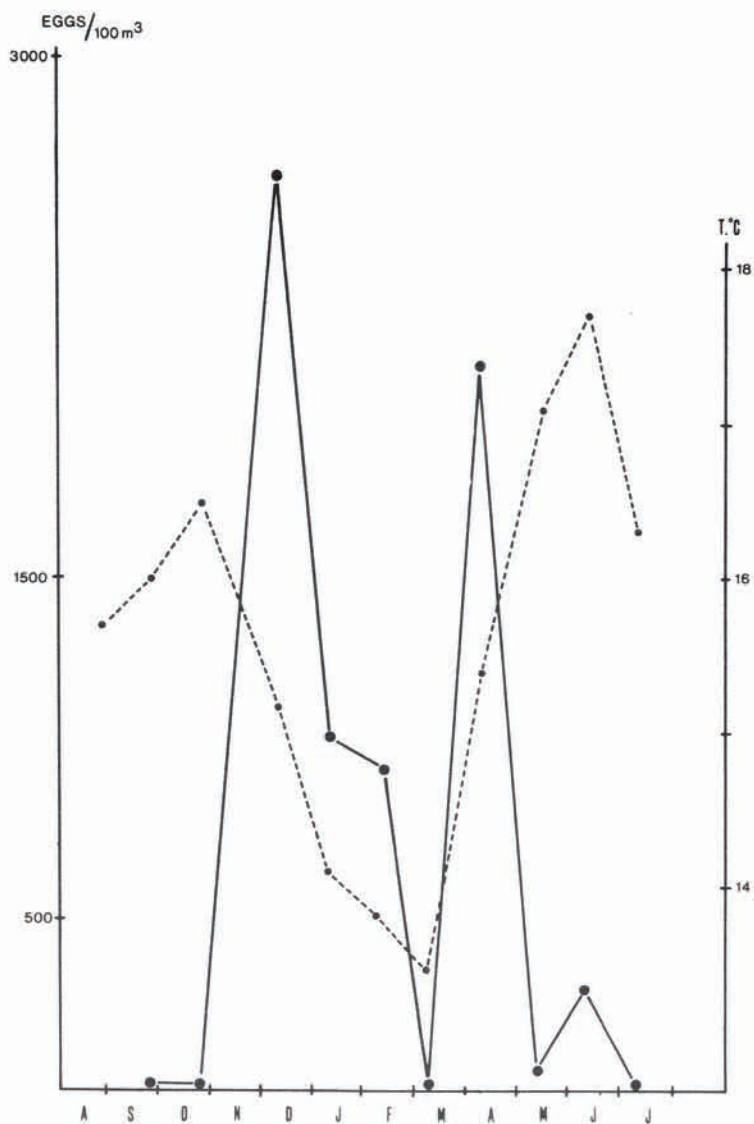


Fig. 2.— Seasonal variation of the spawning activity of *Sardina pilchardus* off Portugal (monthly means of total numbers of eggs sampled are given). The broken line represents the variation of average surface temperatures.

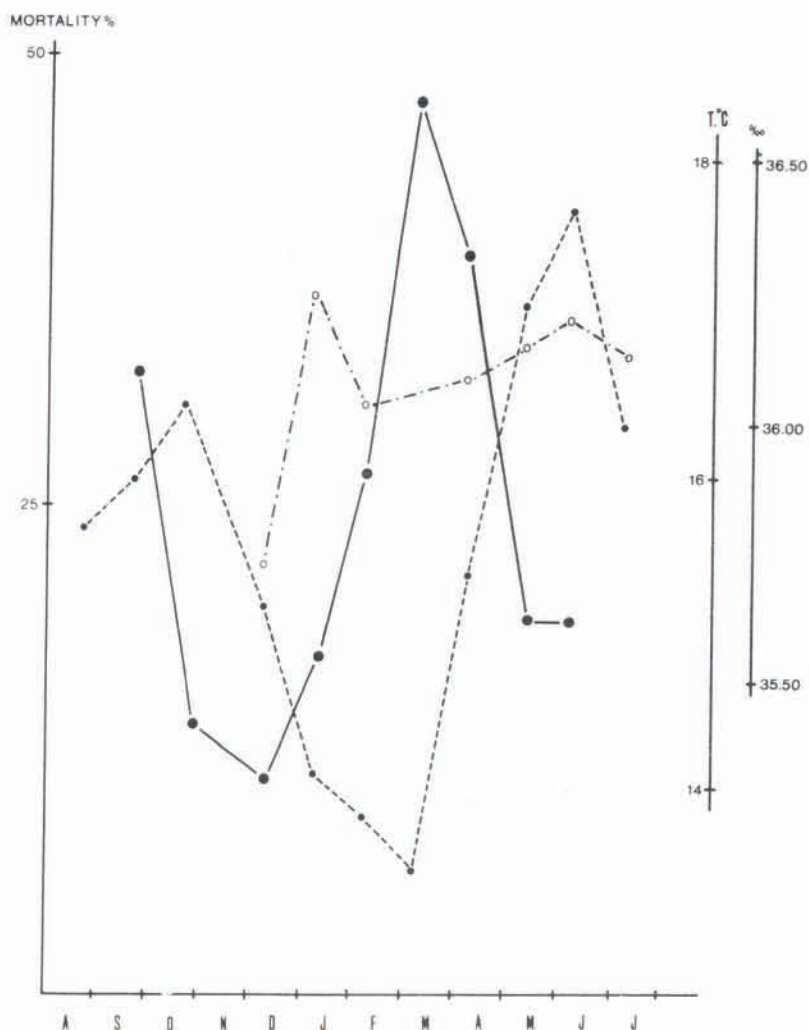


Fig. 3.— Seasonal variation of average relative mortality of sardine eggs. The broken line represents the variation of average surface temperatures and the broken and dotted line indicates the variation of average salinities.

CONCLUSIONS

The results given in the present paper are to be regarded as preliminary for two main reasons :

1. Samples were taken on a restricted area of the portuguese coast and during a limited lapse of time.

2. Causes of mortality and variations of egg dimensions are certainly very complex and have to be related with other factors (biotic and abiotic).

Nevertheless we think that the following conclusions can be made :

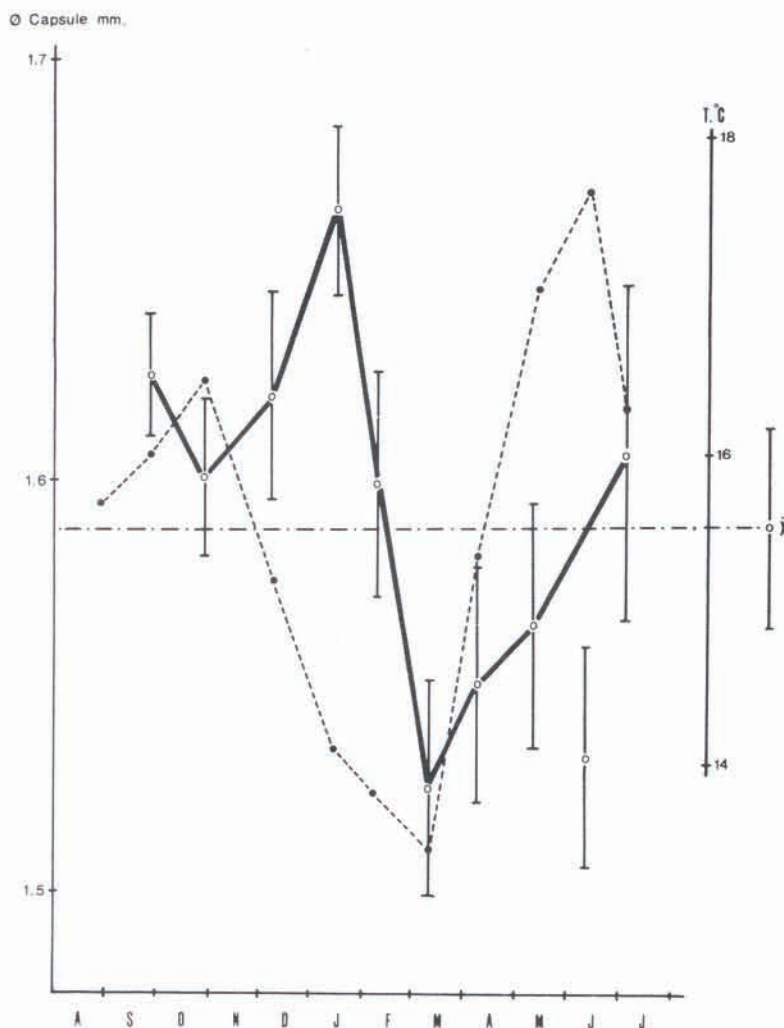


Fig. 4.— Seasonal variation of capsule diameters. Monthly means are given together with 95 % confidence intervals (open circles and vertical bars). The broken line indicates the variation of average surface temperatures.

a) Two main peaks of spawning were found in December and April. In December the average number of eggs sampled was higher than in April. Sobral (1975) mentions that spawning takes place all over the year with a maximum in spring. After the same author, winter spawning is more important in the north part of the portuguese coast and spring spawning is more important in the south.

b) A clear seasonal change in relative mortality was found. The values of mortality seem to be related with temperature among other factors.

c) A cyclic change of the mean dimensions of capsule and oil globule was found. Capsule and oil globule diameters were smaller in March when the temperatures were lower suggesting the existence of some relationship with temperature.

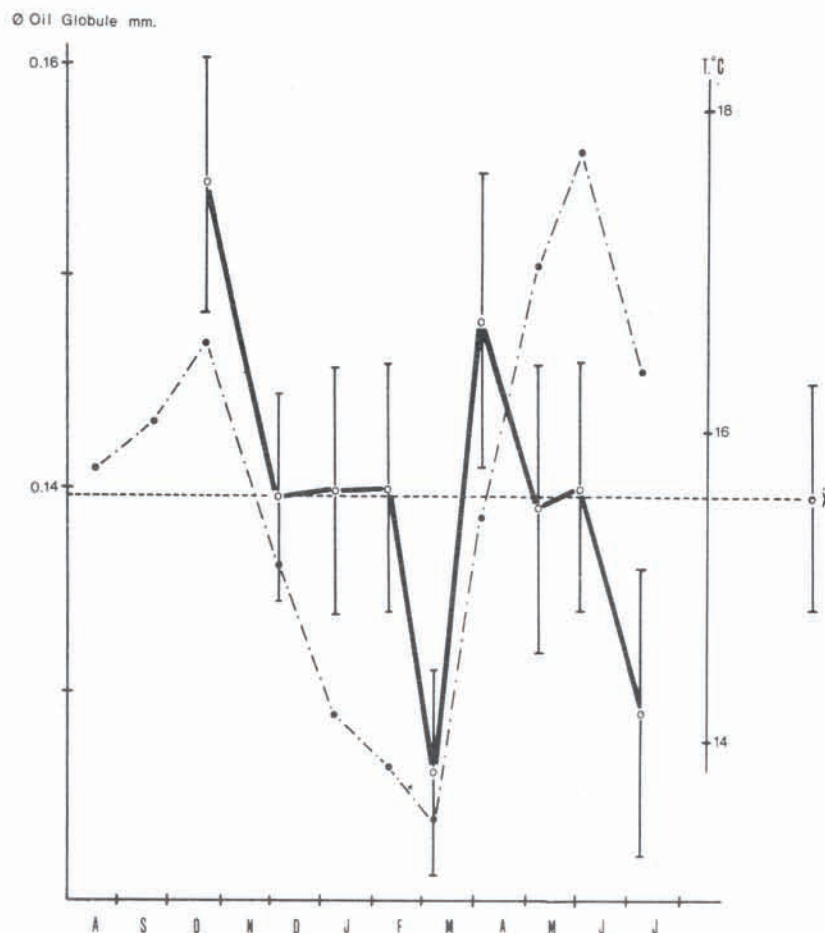


Fig. 5.— Seasonal variation of oil globule diameters. Monthly means are given together with 95 % confidence intervals (open circles and vertical bars). The broken and dotted line represents the variation of average surface temperatures.

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